High Vowels, Glides, and Japanese Phonology*

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1. Introduction
The aim of this paper is to demonstrate that glides (j/w) are not underly-
ingly distinct from high vowels (i/u) in Japanese. It will be shown that, with some exceptions, glides and high vowels are in complementary distribution. The status and representation of the exceptions will also be considered. I also present an analysis of the phonology of a portion of the Sino-Japanese lexicon, with most details discussed here hitherto unreported in the scant literature on Sino-Japanese phonology.

The analyses presented in this paper are guided by the fundamental principle that phonological representations are derived from the phonetic form by removing that which is predictable. In this section I briefly introduce the main formal devices which I employ in the following analysis.

A long segment (e.g. long u) will be written as /uu/, but this is to be understood as an abbreviation for the following formalism, where the phonological features (abbreviated here as u) are attached to two skeletal slots (Xs).

*I wish to express my appreciation to the two anonymous reviewers for this journal, for their helpful comments and useful examples. All remaining infelicities are the responsibility of this writer.
Use of V (vowel) or C (consonant) in place of a skeletal slot is also an abbreviatory transcription, meaning that the segment connected to the slot contains the feature [consonantal] (C) or not (V).

The structure of the mora (μ) is predictable, so it is not part of the underlying structure. Underlying (1) will be moraified as in (2a), which is the equivalent of (2b), the two representations being interchangeable notational variants.

(1) X X
     
     u

(2) a. μ μ
    X X
     
     u

b. μ μ
    X
     
     u

I assume that pre-vocalic (non-moraic) consonants belong to the same mora as the following vowel (Hayes 1995: 53–4), thus capturing the intuition reflected in moraic writing systems such as Japanese kana and Mycenaean Greek linear B. In a CV mora, the V is the head. If the head is deleted or delinked from the mora, the link between the mora node and the preceding consonant will also be severed because of the impossibility of headless moras, syllables, and feet.

Like moraic structure, the structure of the syllable (σ) is predictable and so is assigned by rule. Within the syllable, the onset (O) constitutes a unit (Davis 1990), as does the rime (R), giving a different constituent structure from that of the moraic structure. I will assume that both structures co-exist (Mohanan 1989: 599fn; Lawrence 1989). This Onset-Rime syllabic structure is reflected in the existence of tighter phonotactic constraints between segments within the onset and within the rime than between the onset and the rime (Pike 1967: 387).
2. Distribution and Analysis

Pre-vocalic high vowels and glides in Japanese are distributed as in (3), where the parenthesised combinations are restricted in distribution. This distribution will be the focus of this section. The single-starred forms occur marginally in Foreign Loanwords, and are claimed to occur in derived Native Japanese forms in the speech of some speakers (e.g. [kowe:] from kowai /kowa-i/ ‘afraid’, [kowo:] from /kowa-u/ ‘afraid’), but other speakers pronounce these forms without glides. I shall not discuss these forms in this paper. The double-starred forms do not exist in Japanese.

(3) ii ie (ia) (io) (iu) ui ue (ua) uo uu
    **ji *je ja jo ju *wi *we wa *wo **wu

The vowel sequences enclosed in parentheses in (3) above are common across compound boundaries, both in the Sino-Japanese (4a) and Native Japanese (4b) vocabulary,

(4) a. sian ‘thought’ kioku ‘memory’ kiun ‘trend’ huan ‘anxiety’
    b. hanasiau ‘discuss’ miomo ‘heavy with child’ niuma ‘pack horse’

but otherwise exist only in Foreign Loanwords and a handful of Native Japanese words. Let us for the moment assume that these latter categories, which will be returned to below, can be treated as exceptions. This would then mean that there is a complementary distribution of high vowels and glides in single morphemes. This distribution suggests that, in the case of i/j, we can postulate an underlying /i/ which becomes consonantal j before back vowels, and in the case of u/w we can have underlying /u/ becoming consonantal w before the low vowel. The distinction between i/u on the one hand, and j/w on the other, can be viewed as essentially a matter of syllabification. j/w are the non-syllabic equivalents of i/u, which in Japanese occur in onset position.

The commonness of the parenthesized vowel sequences in (3) in examples of the type in (4) is accounted for if it is assumed that
syllabification does not take place across compound boundaries – i.e. syllabification takes place before compounding. That syllable structure does not straddle compound boundaries in Japanese is evidenced by the following examples, where a period marks compound boundaries.

(5) a. mizu.umi ‘lake’
   b. ka.i ‘lower order’ kai ‘shellfish’
   sa.i ‘difference’ sai ‘time’
   to.ita ‘shutter board’ toita ‘solved’

*mizuumi* (5a), a compound of *mizu* ‘fresh water’ and *umi* ‘sea’, is phonetically four syllables in length, the two adjacent *us* not fusing into one long vowel.\(^1\) The bisyllabicity of the geminate vowel is confirmed by the accentuation of the word. The accent surfaces on the second *u*. Were the geminate vowel to constitute a heavy syllable, in the speech of most Tokyo Japanese speakers the accent would move from the second mora to the nucleus of the syllable – giving in this case an accent on the first *u*.\(^2\) This example is independent evidence that syllabification precedes compounding, and that resyllabification does not take place. Similarly, for the examples in (5b), the compounds have bisyllabic Vi sequences in careful speech, whereas the non-compounded words have monosyllabic Vi sequences (Kawakami 1977: 91).

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1) There is no underlying distinction between long vowels and geminate (heterosyllabic) vowels in Japanese. Geminate vowels (*satooja* ‘foster parent’, *gooku* ‘\(5 \times 10^8\)’) are almost always the result of compounding. The few surface morpheme-internal geminate vowels, such as *ooraka* ‘large-hearted’, *oou* ‘to cover’, under the analysis proposed in this paper, are geminate vowels produced by deletion of an intervening glide, the underlying forms of the two examples given here being /ouo-ra-ka/ and /ouou-ru/ respectively.

2) It is generally understood that an accent cannot surface on the second mora of a heavy syllable in Tokyo Japanese (with the possible exception of a small number of morphemes, e.g. */-si/* ‘Mr’, as in *itou-si* ‘Mr Ito’ with the whole of the second syllable high, in contrast with unmarked */-si/* ‘city’ as in *itou-si* ‘Ito city’, with only the first mora of the heavy syllable high), but this is not the case with all Tokyo Japanese speakers, as evidenced by informants E, F, and P in Sibata (1985).
Exceptions to the syllabification process outlined above are found in the Native Japanese vocabulary (6a) and in Foreign Loanwords (6b).

(6) a. hio ‘sweetfish fry’  b. heriumu ‘helium’
   iiori ‘hermitage’  iion ‘ion’
   miio ‘waterway’  junion ‘union’
   niou ‘to smell’  kiosuku ‘kiosk’
   sio ‘salt, tide’  siatoru ‘Seattle’
   siorasii ‘meek’  ziasutaaze ‘diastase’ (< German Diastase)
   siori ‘bookmark’

(6a) is close to an exhaustive list of occurrences of the parenthesised vowel sequences (3) attested in the Native Japanese vocabulary, and (6b) is a sample of those found in the Foreign Loanword vocabulary. The question of how these exceptions are to be treated will be broached at the end of this section. First it is necessary to clarify the underlying forms of the regular sequences in (3).

The derivationally related verbs kuiru, kujamu ‘regret’ and the adjective kujasii ‘regretful’ can be analysed as having the common stem /kui-/. kuiru contains a vowel-ending verb stem, and is uncontroversially considered to be /kui-/. kujamu and kujasii are formed with the formatives -am- (also in hukur-am- ‘swell’; cf. hukur-e- ‘swell’) and -asi- (also in isog-asi- ‘busy’ < isog- ‘hurry’), giving /kui-am-/ and /kui-asi-/ as their respective underlying forms. Comparing these forms with kuiru shows that the same underlying segment appears as a non-syllabic j when preceding derivational a,3) and as syllabic i when preceding a consonant. Because this distribution of i/j is predictable from syllabification processes as they apply to Japanese, the distinction should not be encoded in the underlying forms of these words, but should be derived via syllabification, an independently required process.

3) /kui-ana-/ gives kuinai ‘not regret’, not *kujanai, but this is not an exception because the negative -ana- is inflectional, not derivational, and may be considered to be adjoined AFTER derivational affixation.
Extending this analysis to the transitive/intransitive pair tajasu, taeru 'sever' gives tajas- /tai-as-/ and tae- as /tai-e-/ (Also hajasu, haeru /hai-/ 'grow'; hujasu, hueru /hui-/ 'increase'; kojasu, koeru /koi-/ 'fertilise'; mojasu, moeru /moi-/ 'burn'.) These examples show that underlying -i-e-surface as e. This raises the question of what the underlying form of the surface sequence ie can be. The answer to this question is provided by the transitive/intransitive pair tuijasu, tuieru 'expend' (also ijasu, ieru /ii-/ 'heal'; hijasu, hieru /hii-/ 'cool'). tuijasu motivates the underlying form /tuii-as-/ , so the intransitive form tuieru will be underlyingly /tuii-e-/. In other words, surface ie comes from underlying /iie/.

Consider now the transitive/intransitive pair kaeru, kawaru 'change' (also kuwaeru, kuwawaru /kuuau-/ 'add'; tutaeru, tutawaru /tutau-/ 'communicate'). kawaru will be underlying /kau-ar-/ , and so the intransitive kaeru will be /kau-e-/. Parallel to /ie/ becoming e, we have /ue/ becoming surface e. How is surface ue derived then? Parallel to ie being derived from /iie/, we might expect ue to be derived from /uue/. This is confirmed by the transitive/intransitive pair sueru, suwaru 'set/sit down' (also ueru, uwaru /uu-/ 'plant'). Intransitive suwaru will be underlyingly /suu-ar-/ , so transitive sueru will be /suu-e-/. That the sequence ue derives from underlying /uue/ is also suggested by the alternation ue ~ uwa- 'above, top'. This has been analysed as vowel lowering (e→a) (Nishikawa 1987: 100), but lowering alone does not account for the appearance of the surface w. That the w is not merely an off-glide transition from the preceding vowel is shown by the parallel example nae~nawa- 'seedling'. If not epenthetic, the w must be part of the underlying form. Assuming vowel lowering to be correct, the underlying forms will be /uue/ 'above, top' and /naue/

4) iie 'no' would thus appear to be /iiie/. As pointed out by an anonymous reviewer, iie is unaccented (or perhaps final-accented), and this is also the case for iija 'no' /iiiial/. On the other hand short ie 'no' /iie/ is accented on the initial mora, as is short ija 'no' /iial/. There is thus a correlation, in these forms, between the numbers of /i/s in the underlying forms and the accentuation. If iie 'no' were /iie/, there would be no such correlation.

5) Also in kawasu /kau-as-/ 'exchange' and the verbal suffix -kau /-kau-/ 'back-and-forth'; a consonant-ending verb stem – see Section 3.
‘seedling’. These examples and the verbs above also suggest that surface vowel sequences must be underlyingly separated by high vowels. If so, the root for the words *kuiru*, *kujamu* ‘regret’, and *kujasii* ‘regretful’ given above must be revised to /kuui-/. The above derivations indicate that the regular sequences given in (3) are derived from underlying forms as in (7).

(7) /ii iie ia io iu uui uue ua uuo uu/

                ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓

[ii ie ja jo ju ui ue wa uo uu]

Such a derivation can be thought of as proceeding in two steps, with $iV \rightarrow jV, uV \rightarrow wV$ (Regressive Gliding) applying regardless of the following vowel, followed by deletion of $j/w$ (Glide Deletion), $j$ before front vowels, and $w$ before [-low] vowels. $ii$ and $uu$ are unaffected by Regressive Gliding as these are not vowel sequences, but are unitary vowels pronounced long, as indicated by the formalism in (1).

(8) /ii iie ia io iu uui uue ua uuo uu/

                ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ Regressive Gliding

            ije ja jo ju uwi uwe wa uwo

                ↓ ↓ ↓ ↓ Glide Deletion

[ii ie ja jo ju ui ue wa uo uu]

The processes involved in the derivations in (8), where $j$ and $w$ are abbreviations for $i$ and $u$ which are not heads of moras, can be formulated as follows.
Regressive Gliding erases the mora node instead of dissociating it, in order to prevent compensatory lengthening, and it specifies a vowel for the following mora, so as not to apply before moraic consonants.

Let us return now to the representation of the exceptions in (6). The Native Japanese exceptions (6a) all involve the sequence [io]. If these forms are given the underlying representation /-iuo-/, this would account for the lack of exceptions in ia or iu. This is because any other underlying sequences would produce glides (10) instead of phonetic ia or iu.

(10) /iuua → iwa /iiaa → ija
    /iuua → iuua /iiu → iju

Foreign Loanword exceptions (6b), on the other hand, may contain surface ia and iu, and so require a different approach. Let us consider the underlying form of [ciatoru] 'Seattle' (6b). Assuming that Japanese glides are derived from high vowels by syllabification processes, the least abstract underlying form that could plausibly be proposed would be /siatoru/, but under the analysis proposed above, this would be the underlying form of [ciatoru] 'shuttle' because unmarked /sia/ becomes sja (phonetic [ca]) by Regressive Gliding. In order to generate [piatoru] from /siatoru/, it is necessary to mark this form as an exception to Regressive Gliding.6)

Let us now consider another Foreign Loanword, babaraoa 'Bavarian cream' (< French bavarois). In this form we have the sequence oa, a

6) This option could also be employed for the Native Japanese exceptions in (6a), but would leave unaccounted for why there are no ia or iu exceptions.
sequence which does not exist morpheme-internally in Native Japanese forms. If, as we have seen for Native Japanese forms, surface vowel sequences are underlyingly separated by high vowels, the underlying form for this Loanword would be either /babaroua/ or /babaroia/. These would be expected to give surface -owa or -oja respectively. Rather than postulate a glide deletion rule which would apply only to segments marked to undergo it, let us instead assume that the generalisation that surface vowel sequences are underlyingly separated by high vowels applies only to the Native Japanese vocabulary. The underlying form for babaroa can thus be unexceptional /babaroa/. That oa (also ea) is not found as a tautomorphemic vowel sequence in the Native Japanese vocabulary is accounted for by the need to have underlying high vowels break up surface vowel sequences and the fact that Glide Deletion (9b) leaves glides preceding a untouched. On the other hand, both oa and ea are common in the Foreign Loanword vocabulary.

Foreign Loanwords are exceptions to a number of phonotactic generalisations in Japanese. For example, the sequences [ti, tu, tj] are exceptional in that they have failed to undergo affrication, and [φa, φi] have failed to undergo debuccalisation. Words such as [partiː] ‘party’, [dubai] ‘Dubai’, [kɔd juryo] ‘corduroy’, and [ʃirumu] ‘film’ are therefore exceptional in that they contain segments which are marked not to undergo specific rules. Similarly [ceϕu] /sieϕu/ ‘chef’, [tcesu] /tiesu/ ‘chess’, [indzeˈnɛri] /inzienieeri/ ‘Ingegneri (surname of Italian composer)’, and [jesperuseN] /iesuperuseN/ ‘Jespersen’ need only be marked as exceptions to Glide Deletion (9b). 7) So long as [ce], [tce] etc. are present only in the

7) Itô & Mester (1995: 830–2) claims that a constraint against je exists for the whole of the Japanese lexicon (including the Foreign Loanword vocabulary). That [ce], [tce] exist in the peripheral (including Foreign Loanword) vocabulary is, according to Itô & Mester, due to c and tc not being sequences of C+j but being single consonants with palatal co-articulation in this sub-field of the Japanese lexicon. Under this analysis, n and ç (e.g. /berueμu/ [beruç emu] ‘Berchem’) will be analysed in parallel fashion. However, [jesperuseN] ‘Jespersen’, [jetsu] ‘Yeats’ are not accounted for under this analysis because these still fall foul of the je-constraint. Itô & Mester claims as an advantage of
Foreign Loanword vocabulary, they may be treated as exceptions and need not be seen as evidence for a newfound phonemic status (contra Tsujimura 1996: 38–40; Itô & Mester 1995: 826).

These examples illustrate two ways to mark exceptions: the use of prespecification of structure (as in [cio] /siuo/ ‘salt’ (6a)); and marking forms not to undergo a rule (as in ti, Øi, cē etc. in Foreign Loanwords, and as in siatoru ‘Seattle’ (6b)). A third option, the marking of forms to undergo a minor rule, will be illustrated in Section 4.

Underlying /iu/ undergoes moraification and Regressive Gliding (9a) to produce surface ju. There are cases, however, where a sequence of i + u results, not in short ju, but in long juu. One such example is adjective stem + adverbial -u (11). (Another example will be given in Section 3.)

(11) atarasi + u → atarasjuu [atarasu:] ‘newly’
    ooki + u → ookjuu [ookju:] ‘largely’

This is a derived environment and the morphemes involved can be interpreted as being fully moraified when concatenated. To convert the bimoraic iu in (11) to juu, the i preceding u needs to be detached from its mora node (NOT deletion of the mora node as in Regressive Gliding (9a)) allowing the vacated mora slot to attach to the u (compensatory lengthening)(Poser 1985: 178). Let us call the detachment process involved here i-delinking (12).

8) That this process applies not only before u is shown by the form /me-oto/ meoto ~ mjooto ‘husband and wife’, with the latter form via intermediary *mioto. It also applies before moraic w (/ziw/ zjuu ‘ten’, see Section 4 and Lawrence 1999), but does not apply before the moraic nasal. This last detail is not captured by (12) as formulated, but I am unsure how to improve the formulation. An anonymous reviewer has suggested specifying the feature [−nas], but I am reluctant to do this in the absence of evidence that non-nasal segments in Japanese are specified as [−nas].
(12) \( i \)-delinking
\[
\begin{array}{c|c|c|}
\mu & \mu & X \\
\hline
X & X & i \\
\end{array}
\]

(12) does not apply in /kuui-am/- ‘regret’ (\( kujam-\), not \( *kujaam-\)). This suggests that \( i \)-delinking applies, at least with Native Japanese vocabulary, at the word level, and not at the stem-formation level. That Regressive Gliding does not apply in (11) is evidence that \( i \)-delinking applies prior to Regressive Gliding (see also Section 4).

A non-derived (morpheme-internal) instance of \( i \)-delinking and consequent compensatory lengthening is observed in a widespread and commonly used pronunciation of the Loanword meaning ‘kiwifruit’. The ‘standard’ Japanese form is [kiui], but it is commonly pronounced (and sometimes written) as [kju:i]. kiui will be underlyingly /kiui/ with the first /i/ marked as an exception to both Regressive Gliding and \( i \)-delinking. The more common pronunciation kjuui will also be underlying /kiui/, marked as an exception to Regressive Gliding but not \( i \)-delinking. Another common pronunciation, [kiiui], may be underlyingly /kiiui/, with the long i marked as an exception to Regressive Gliding. The change from kiui to kjuui or kiiui will thus be a reduction in the markedness of the underlying form. One innovation (kjuui) retains the same underlying segment sequence but on the surface becomes rather separated from the source form (orthographic “kiwi”); the other innovation (kiiui) adds a long vowel to the underlying form in order to maintain a vocalic i and a short u. Both innovations are marked as exceptions to fewer rules than the ‘standard’ form.

A similar example to the above is the alternation observed between -iumu and -juumu in Foreign Loanwords which, in the source language, end in -ium (mainly scientific words such as names of elements and words
like *planetarium, symposium*)(Broadcasting Culture Research Institute 1992:212). Taking *heriumu* (6b) ~ *heriuumu* 'helium' as an example, *heriumu* would be underlying /heriumu/, with the *i* marked as an exception to both Regressive Gliding and *i*-delinking (parallel to *kiui* above), and *heriuumu* will either have the same underlying form, but marked as an exception to only Regressive Gliding, or the underlying form will be /heriuumu/. Presumably, for speakers who have variation between the two forms in their speech, the former form will be the underlying form, and those speakers who use only the *-juumu* form will have the less abstract /-iuumu/ as the underlying form.

3. Consonant-ending verb stems

Japanese verb stems are classified according to whether they end with a consonant or with a vowel, this distinction being reflected in the surface forms of the endings. Vowel-ending stems end with either of the [+back] vowels, *i* or *e*.9) Consonant-ending stems end with any consonant except *d, z, p/h,* or *j.*10) What is relevant to this paper is the fact that non-syllabic *w* is a possible verb-stem-final segment which groups with consonants. This does not, however, necessarily mean that *w* must be part of the underlying representation of these verbs. Because it is entirely predictable that any verb stem which underlyingly ends in /u/ must be interpreted as a consonant-ending verb stem, it is possible that underlying verb-stem-final

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9) This statement applies to verb stems, and not verb roots. For example, the root *ko- 'surpass'* ends in a [+back] vowel, but is expanded by -*e-* (intransitive) or -*s-* (transitive) to give stems which conform with the canonical verb stem structures.

10) Although this distinction between vowel-ending and consonant-ending verb stems is clear (e.g. consonant-ending verb stems + negative /-ana-/ always surface as *-ana-*, whereas with vowel-ending verb stems the negative is always surface *-ina- or -ena-*, never *-ana-*, with the *i/e* being from the verb stem), in the last decade a number of Japanese native-speaker linguists have been classifying some vowel-ending verb stems as ending in *r* (Ura 1994; Tsujimura 1996: 177; Matsuoka 1998: 61; Itô & Mester 1999: 96fn23). Although not made explicit, such an analysis seems to require two kinds of *r* in Japanese. In this paper I will use the simpler analysis.
/u/ is converted to a consonant by rule. A consonant-ending verb stem like suw- 'suck' will thus be generated as in (13).

(13)

\[
\begin{array}{c}
\text{X X X} \\
\text{s u s u s u}
\end{array} \rightarrow \begin{array}{c}
\text{X X C} \\
\text{s u s u s u}
\end{array} \rightarrow \begin{array}{c}
\text{X X C} \\
\text{s u s u s u}
\end{array}
\]

The verb juu 'say' (/iw-ru/) will be derived as follows, with w deleted before u by Glide Deletion (9b), this creating the environment for i-delinking (12) and compensatory lengthening.

(14)

\[
\begin{array}{c}
\text{X X} \\
\text{i u i u i u}
\end{array} \rightarrow \begin{array}{c}
\text{X C} \\
\text{i u i u i u}
\end{array} \rightarrow \begin{array}{c}
\text{X C} \\
\text{i u i u i u}
\end{array} \rightarrow \begin{array}{c}
\text{X C} \\
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\text{X C} \\
\text{i u i u i u}
\end{array} \rightarrow \begin{array}{c}
\text{X X} \\
\text{i u i u i u}
\end{array}
\]

4. Sino-Japanese Phonology

There are tens of thousands of Sino-Japanese morphemes, but the majority of these are unknown to the average native speaker of Japanese. In the tables below, I have taken the counts from the tables of Sino-Japanese formatives given in the main text of the *Sinmeikai Kokugo Ziten* (2nd edition; Sanseidou) and the free forms listed as entries therein, and have

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11) Here, as with the rest of this paper, I am referring to Sino-Japanese morphemes, and not Sino-Japanese graphs (kanji).
supplemented these with a number of other morphs$^{12}$ which are known to all Japanese speakers. The figures in these tables are intended to be indicative of the minimum number of Sino-Japanese morphs present in a Japanese native-speaker's lexicon. In the Sino-Japanese forms in the tables below, $z$ preceding a high vowel/glide is used for both /z/ and /d/, the distinction between these two consonants being neutralised in favour of $z$ on the surface.

It is well-known that the phonological structure of Sino-Japanese morphemes displays a number of characteristics not a part of the Native Japanese or Loanword vocabulary. In this section I will analyse one such characteristic which is manifested in several different areas of Sino-Japanese phonology. It will be shown that there is no need for an underlying /j/ distinct from /i/.

<table>
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<tr>
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Table 1: Numbers of Sino-Japanese morphs of the shape (C)(j)u(:)

This distribution might, at first blush, suggest the existence of a

$^{12}$ Supplemented morphs are: $zu$ 'bean', $zjoku$ 'humiliation', $zjuku$ 'ripe', $njaku$ 'young', $natu$ 'press', $hotu$ 'start', $ratu$ (meaning uncertain, but found in the bimorphemic $haturatu$ 'lively', $akuratu$ 'villainous', $sinratu$ 'scathing').
morpHEME-STRUCTURE CONDITION (MSC) WHICH FUNCTIONS TO DISALLOW SINO-JAPANESE MORPHEMES OF THE SHAPE CJu (C ≠ s,z). A CLOSER LOOK, HOWEVER, REVEALS A MORE INTERESTING DISTRIBUTION TO BE ACCOUNTED FOR. ALL OF THE Su AND Zu SINO-JAPANESE MORPHS HAVE ALTERNATIVE PRONUNCIATIONS IN si, sju, suu, sjuu (FOR su) AND to, tou (FOR zu). IF IT IS ASSUMED THAT THE ALTERNATIVE PRONUNCIATIONS ARE BASIC, AND THAT su, zu ARE DERIVED,13) THIS WOULD LEAVE A GAP IN THE Cu COLUMN IN TABLE 1 FOR THE sJu/zju FORMS TO BE DERIVED FROM. IN OTHER WORDS, FIRST INDICATIONS ARE THAT THERE MAY BE A GENERAL MSC (*Ci u) ON THE UNDERLYING FORM OF SINO-JAPANESE MORPHEMES, AND A PROCESS WHICH CONVERTS UNDERLYING /su, zu/ TO sJu, zJu. BEFORE FORMULATING THIS LATTER PROCESS, IT IS FIRST NECESSARY TO CONSIDER THE UNDERLYING FORM OF THE SURFACE Cjuu MORPHS.

THERE ARE SEVERAL SINO-JAPANESE MORPHEMES WHICH DISPLAY THE ALTERNATION (C)u ~ (C)juu.

13) SPECIFICALLY, THE su~si ALTERNATING MORPHS CAN BE DERIVED FROM UNDERLYING /si/ VIA A MINOR RULE OF BACKING ABLAUT; su~sju FROM /su/ VIA i-INSERTION (17); su~suu FROM /suu/ VIA SHORTENING ABLAUT (AND PERHAPS ALSO MARKED AS AN EXCEPTION TO (17)); AND su~sjuu FROM /siu/ VIA i-DELETION (SEE (15)). Zu~tou (2 MORPHMES) AND Zu~to WILL SIMILARLY BE RELATED VIA VOICING ABLAUT AND OTHER MINOR RULES. THESE ABLAUT RULES ARE INDEPENDENTLY REQUIRED TO ACCOUNT FOR SUCH ALTERNATIONS AS THE FOLLOWING (PERIOD MARKS A MORPHEME BOUNDARY):

BACKING ABLAUT

gen~gon 'word' in ta.gon~ta.gen 'telling others'; jui.gon 'last will'

SHORTENING ABLAUT

juu~ju 'play' in juu.ran 'excursion', ju san 'excursion'

huu~hu 'style' in huu.sai 'appearance', hu.zei 'appearance, taste'

VOICING ABLAUT

kuu~guu 'shrine' in nai.kuu 'inner shrine', guu.zi 'chief priest'

son~zon 'exist' in ki.son 'already existing', ziu.zon 'actually existing'

BACKING ABLAUT MAY ALSO APPLY IN THE NATIVE JAPANESE VOCABULARY, AS IN:

kuti 'mouth' but kutu.wa 'bridle bit' (COMMONLY USED IN THE WORD saru-gutuwa 'gag')

se 'back' but somuku 'turn one's back', so.bira 'back' (AS IN THE EXPRESSION sobira-o kaesu 'turn one's back') (CONTRA VANCE 1987: 150 (THE SPELLING WHICH VANCE CLAIMS IS NOT USED IS ATTESTED – E.G. OZAKI 1972: 235)).
It is often useful, when looking at an alternation involving two differences, to try and capture the alternation in terms of one difference, with the second difference being a consequence of the first. In this case we have differences in the presence/absence of the glide /j/, and also a vowel length contrast. It is possible to view this alternation as being based on the presence/absence of the glide element, and that the lengthening is secondary. The underlying forms can be considered to be /iu/ ‘have; right’, /kiu/ ‘nine’, /riu/ ‘flow; stay’, with compensatory vowel lengthening occurring when the /i/ is glided, as in (16).

(16)       (12)  
   /i/ /u/ → /i/ u /i/ 
   k i u  k i u  k i u  k i u

The short forms of the morphemes in (15) will be derived if the morphemes are marked to undergo a minor rule of i-deletion in certain words. 14)

Table 1 and the alternations in (15) indicate that Sino-Japanese /Ci/ is underlying /Ciul/, and that /ju/ is underlying /iu/. This differs from the Native Japanese vocabulary. In the Native Japanese vocabulary /iu/ gives surface ju (8) with no evidence of compensatory lengthening. This can be considered to be due to Regressive Gliding which removes the mora status of high vowels before a moraified vowel. The same situation would also appear to obtain in the Foreign Loanword vocabulary, where

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14) This minor rule is independently required to account for such alternations as the following (period marks a morpheme boundary).
   kjaku~kaku ‘person’ in rjo.kaku~rjo.kjaku ‘traveller’, ken.kaku~ken.kjaku ‘swordsman’
   kjo~ko ‘basis’ in kon.kjo ‘basis’, sjou.ko ‘evidence’
   sja~sa ‘sand’ in haku.sja~haku.sa ‘white sand’, sa.tetu ‘iron sand’, do.sja ‘dirt and sand’
short *ju* is not uncommon (e.g. [junıːku] /uniiku/ ‘unique’, [kjuriː] /kiurii/ ‘curie’, [komjunıkeːsısın] /komiunikeesıon/ ‘communication’ etc.). In the Sino-Japanese vocabulary, however, underlying *i* is assigned mora status, as demonstrated by the lengthening in /Ciu/ (16) and the alternation between *u* and *juu* (15). The Sino-Japanese vocabulary is thus not subject to Regressive Gliding (9a).\(^{15}\)

What then is the underlying form of the 7 morphs with the surface form *ju*? Two of these morphs alternate with *juu*, so can be considered to be /iu/ but marked to undergo a minor rule of shortening. It would seem that the remaining 5 morphs must be treated as exceptions.\(^{16}\) They could be treated as exceptions to compensatory lengthening, but another possibility is that they are exceptions to the underlying *i* being given moraic status. Compared to the 15 morphemes /iu/ [juː] which are bimoraic, the 7 morphemes which surface as monomoraic [ju] may be considered to be exceptions in that they undergo Regressive Gliding (9a), in this respect being treated more like Foreign Loanwords or Native Japanese morphemes than Sino-Japanese morphemes.

Assuming, from Section 2 and as in the above discussion, that *j* is formed from gliding underlying *i*, we can see that there cannot be a MSC against underlying Sino-Japanese *Ciu* (or *Cju*). The surface *Cjuu* forms are underlying /Ciu/, and *sjuu* [cuː] comes from /siu/. If /su/ is the underlying form for *sju* [cu], then how is this derived? Insertion of *i* would give *siu*, which would then be expected to undergo gliding and compensatory

\(^{15}\) Whereas Sino-Japanese /((C)iu/) surfaces as (C)juː, Sino-Japanese /((C)ia)/, /((C)io/) give surface Cja, Cjo. Before non-high vowels, *i* is glided but there is no compensatory lengthening. This may be attributed to a Sino-Japanese version of Regressive Gliding applying only before [-high] vowels, or, alternatively, in the Sino-Japanese vocabulary *i*-delinking applies before all vowels. Compensatory lengthening will not occur because, except at a very shallow level, bimoraic Sino-Japanese morphemes may not end in a [-high] vowel (Ito & Mester 1996: 19). A persistent constraint to this effect will block compensatory lengthening where the final vowel is not [+high].

\(^{16}\) The two morphs with the surface forms *ju* ~ *juu* have the meanings of ‘play, wander’ and ‘reason’. The five Sino-Japanese morphs with the surface form *ju* are those with the meanings ‘care’, ‘counsel’, ‘joy’, ‘oil’, and ‘transport’.  

lengthening as in (16). Insertion of /j/ is not possible if there is no underlying distinction between i and j. What appears to be necessary is insertion of a non-moraic i, as in (17).

\[(17) \emptyset \rightarrow i / \begin{array}{c}
\text{s} \\
\text{z}
\end{array} \_u\]

The non-moraic nature of this inserted i need not be stipulated, however, if the moraification of all Sino-Japanese vowels takes place once only, on the underlying form. On this assumption, because the i inserted by (17) is not part of the underlying structure of the morpheme, it will not be assigned mora status.

This will give rise to the following derivations for underlying /siu/ and /su/.

\[(18) \begin{array}{a}
\text{a.} & \rightarrow & \mu & \mu & (12) & \mu & \mu \\
\text{s i u/} & \text{s i u} & \text{s i u} & \text{s i u} & \text{[cu:]} \\
\text{b.} & \rightarrow & \mu & (17) & \rightarrow & \mu \\
\text{s u/} & \text{s u} & \text{s i u} & \text{s i u} & \text{[cu]} \end{array}\]

The total lack of Sino-Japanese morphs of the shape *Cjui and the commonness of sui (18 morphs) and zui (3 morphs) indicate that application of (17) is blocked by the presence of i in the rime. In contrast, Sino-Japanese morphs of the shape jui (2 morphs) are well-formed. This distinction suggests that although the glide in jV is in the onset, in glide-medial syllables (CjV), the j is syllabified as part of the rime. Evidence that the j in CjV is part of the rime comes from the close phonotactic relationship the post-consonantal j in *Cjui has with the syllable-final i (Pike 1967:387). To capture the lack of *Cjui Sino-Japanese morphs and the fact that sui, zui fail to undergo i-insertion (17), it is proposed that there is a persistent constraint (19) which disallows two occurrences of i
in the same syllable rime.

(19) * R
    i (V) i

(19) is a sub-case of a co-occurrence restriction which has been proposed for Chinese (Shen 1990: 176), and has no doubt entered Japanese from Chinese, albeit indirectly through the independent handling of large numbers of related morphs.

(17) is not restricted to monomoraic morphemes, also being motivated in bimoraic morphemes, as can be seen from the distribution of morphs in Tables 2 and 3.

<table>
<thead>
<tr>
<th>(C)aku</th>
<th>(C)jaku</th>
<th>(C)oku</th>
<th>(C)joku</th>
<th>(C)uku</th>
<th>(C)juku</th>
</tr>
</thead>
<tbody>
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<td>aku</td>
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<td>oku</td>
<td>joku</td>
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<tr>
<td>2</td>
<td>8</td>
<td>5</td>
<td>6</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>kaku</td>
<td>kjaku</td>
<td>koku</td>
<td>kjoku</td>
<td>kuku</td>
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</tr>
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<td>20</td>
<td>4</td>
<td>9</td>
<td>3</td>
<td>—</td>
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<td>gaku</td>
<td>gjaku</td>
<td>goku</td>
<td>gjoku</td>
<td>guku</td>
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<td>2</td>
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<td>sjaku</td>
<td>soku</td>
<td>sjoku</td>
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<td>5</td>
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<td>doku</td>
<td>zjoku</td>
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<td>haku</td>
<td>hjaku</td>
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<td>8</td>
<td>baku</td>
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<td>5</td>
<td>mkaku</td>
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<td>2</td>
<td>raku</td>
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<tr>
<td>10</td>
<td>5</td>
<td></td>
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<tr>
<td>—</td>
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<tr>
<td>soku</td>
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<tr>
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</tbody>
</table>

Table 2: Numbers of Sino-Japanese morphs of the shape (C)(j)Vku

17) Evidence has been given suggesting that prevocalic glides in Mandarin Chinese belong to the onset, and not the rime (Duanmu 2000: 84–7). See Bao (1994: 75–6) for evidence that prevocalic glides belong to the rime in Taiwanese.
From Table 2 it can be seen that Sino-Japanese morphs do not take the form \((C)juku\), except where \(C = s, z\). This distribution is also accounted for if there is a MSC \(*iuk\), and if it is assumed that \(sjuku, zjuku\) are all derived from underlying /suk/, /zuk/ by rule (17).\(^{18}\)

The distribution of \(CjVtu\) Sino-Japanese morphemes is somewhat different. As can be seen from Table 3, with the exception of \(sjutu\) and \(zjutu\), \((C)jVtu\) is a non-occurring Sino-Japanese morph structure.

<table>
<thead>
<tr>
<th>(C)atu</th>
<th>(C)jatu</th>
<th>(C)otu</th>
<th>(C)jotu</th>
<th>(C)utu</th>
<th>(C)jutu</th>
</tr>
</thead>
<tbody>
<tr>
<td>atu 1</td>
<td>jatu 9</td>
<td>otu 1</td>
<td>jotu 2</td>
<td>utu 3</td>
<td>jutu 1</td>
</tr>
<tr>
<td>katu 7</td>
<td>kjatu 1</td>
<td>katu 1</td>
<td>jotu 2</td>
<td>kutu 3</td>
<td></td>
</tr>
<tr>
<td>gatu 7</td>
<td>gjatu 1</td>
<td>gotu 1</td>
<td>gjotu 2</td>
<td>gutu 3</td>
<td></td>
</tr>
<tr>
<td>satu 7</td>
<td>sjatu 1</td>
<td>sotu 1</td>
<td>sjotu 2</td>
<td>sutu 3</td>
<td></td>
</tr>
<tr>
<td>zatu 1</td>
<td>zjatu 1</td>
<td>zotu 1</td>
<td>zjotu 2</td>
<td>zutu 3</td>
<td></td>
</tr>
<tr>
<td>datu 1</td>
<td>tjatu 1</td>
<td>dotu 1</td>
<td>tjotu 2</td>
<td>tutu 3</td>
<td></td>
</tr>
<tr>
<td>natu 1</td>
<td>njatu 1</td>
<td>notu 1</td>
<td>njotu 2</td>
<td>nutu 3</td>
<td></td>
</tr>
<tr>
<td>hatu 4</td>
<td>hjatu 1</td>
<td>hotu 1</td>
<td>hjotu 2</td>
<td>hutu 3</td>
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</tr>
<tr>
<td>batu 5</td>
<td>bjatu 1</td>
<td>botu 1</td>
<td>bjotu 2</td>
<td>butu 3</td>
<td></td>
</tr>
<tr>
<td>ratu 1</td>
<td>rjatu 1</td>
<td>rotu 1</td>
<td>rjotu 2</td>
<td>rutu 3</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Numbers of Sino-Japanese morphs of the shape \((C)(j)Vtu\)

Here too there is evidence for (17). (17) allows for \(sjutu, zjutu\) to be derived from underlying /sut/, /zut/, resulting in an underlying distribution which is readily captured by postulating a MSC \(*iVt\).\(^{19,20}\)

\(^{18}\) The final vowel is predictable in around 95% of bisyllabic Sino-Japanese morphemes, so it is assumed to be inserted by rule (Lawrence 1999: 23-4; Tateishi 1990).

\(^{19}\) This MSC operates only in the Sino-Japanese vocabulary. \(jatu\) [jatsu] ‘person, thing’ is a well-formed Native Japanese morpheme/word, and \(sjatu\) [catsu] ‘(under)shirt’ is a well-formed Foreign Loanword.

\(^{20}\) A similar distribution is observed with Sino-Japanese morphs of the shape \((C)(j)uN\). There are no Sino-Japanese \((C)jVN\) morphs except \(sjun\) (6 morphs) and \(zjun\) (12 morphs), and these will be derived via rule (17). The lone
If the 7 morphs pronounced ju are recognized as exceptions, the distribution of surface j in Sino-Japanese morphs (Tables 1, 2, and 3) can be accounted for without positing an underlying distinction between i and j. The distribution in Table 1 strongly points to /Ciui/ as being the underlying form for Cj1uu. Although it is clear that Sino-Japanese j is underlying /i/, at least in (C)j1uu forms, a problem arises as to why Regressive Gliding (9a) does not apply to convert underlying /Ciui/ to *Cjiu. The explanation I will explore here is that i-delinking (12) is ordered before and therefore bleeds Regressive Gliding. That Regressive Gliding in Polish is a cyclic phonological rule and not part of the syllable structure algorithm (Rubach & Booij 1990: 141–2) suggests that the same is possible in Japanese. By the Elsewhere Condition (Kiparsky 1982: 8) the expected ordering is i-delinking before Regressive Gliding, so in this regard the Sino-Japanese situation is what is expected. In the Native Japanese vocabulary i-delinking applies at the word level (11, 14), and not at the stem-formation level. If it can be assumed that Sino-Japanese morphemes are not subject to the stem-formation morphophonology, they will not undergo Regressive Gliding (which applies at both the stem-formation and word levels) until the word level (Diagram 1), where it will apply only if not bled by i-delinking (12). The effects of Regressive Gliding in Sino-Japanese morphemes are seen only in /ua/-initial sequences.

example of sun, ‘inch’, will have to be marked as an exception to (17). This distribution suggests that the MSC reflected in Table 3 is */VC (C ≠ [DOR]).

A similar exclusive specification of consonant place-of-articulation is found in another MSC on Sino-Japanese morphemes: *Cui (C ≠ [COR]). However, not all place-of-articulation specifications in MSCs on Sino-Japanese morphemes are exclusive: *C1uC2 (C1 = [−cont, COR]), *Cuk (C = [−cont])(assuming here that surface [h−ϕ−ç−p] is underlying /ϕ/ and not /p/), contra McCawley (1968: 77–9), Itô & Mester (1996: fn3) and others; in this paper I have been using /h/ for ease of exposition), *Cio (C = [LAB]). This last MSC accounts for the lack of Cjo, Cjok (Table 2), and Cjon morphemes, where C is a labial consonant. The existence of labial-initial Cjou [Cjo:] morphs indicates that these must be derived from another underlying morpheme structure, the most likely candidate being /Ciaul/.
Phonetice $w$ is highly restricted in distribution in Japanese. It occurs only in syllable-initial position (no $Cw$- syllables) before $a$ (rule (9b)). Martin (1952: 28) gives /jiwu/ ~ /juwu/ (Martin’s /j/ is a prepalatal affricate) as the underlying form for $zjuu$ [dzuː] ‘ten’, based on its behaviour paralleling other numbers which end in consonant + high-vowel sequences ($iti$ ‘one’, $roku$ ‘six’, $hati$ ‘eight’, $hjaku$ ‘hundred’), namely that the final mora of such numbers assimilates to the initial voiceless consonant of a following number or classifier, resulting in a geminate consonant. Lawrence (1999) shows that $zjuu$ ‘ten’ produces gemination even in environments where other numbers do not, and concludes that $zjuu$ ‘ten’ is therefore /ziw/ ~ /ziuw/, and that at no stage is epithetic (paragogic) $u$ inserted. $kjuu$ ‘nine’ (/kiu/) and $zjuu$ ‘ten’ (/ziw/) are thus a near-minimal pair distinguished by $u/w$ – in a position (syllable-final) where the ‘$w$ if onset; $u$ if rime’ distinction cannot be appealed to. Unlike the stem-final $u$ of verb stems (Section 3), a regular rule cannot be appealed to, as it is probably limited to only one or two other morphemes (e.g. /gaw/ [goː] ‘combine’). However, these morphemes do undergo the same process of stem-final-$u$ gliding that verb stems undergo, so they can be viewed as being marked to undergo a minor rule to this effect. /ziu/ ‘ten’ and /gau/ ‘combine’ are marked to undergo this minor rule, making them irregular, whereas /kiu/ ‘nine’, being unmarked for minor rules, is regular. $zjuu$ ‘ten’ will be derived as in (20a), and $zikkai$ ‘ten times’ as in (20b).

<table>
<thead>
<tr>
<th>Sino-Japanese Phonology</th>
<th>Native-Japanese Phonology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>stem-formation level</strong></td>
<td><strong>Regressive Gliding (9a)</strong></td>
</tr>
<tr>
<td><strong>word level</strong></td>
<td><strong>$i$-delinking (12)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Glide Deletion (9b)</strong></td>
</tr>
</tbody>
</table>

Diagram 1: A possible account of the interaction of Regressive Gliding and $i$-delinking
i-delinking (12) applies after affixation of classifiers (such as -kai ‘times’) and is bled by the process which leads to the gemination in (20b). For speakers who have *jukkai ‘ten times’, the underlying form will be /ziuul/ (stem-final u marked to undergo gliding to give /ziuw/).

5. Conclusion

In this paper I have attempted to show, from a purely synchronic perspective, that the distinction between the Japanese high vowels and glides is, in almost all cases, predictable and should therefore not be considered part of the underlying structure of Japanese. The underlying inventory of Japanese segments will contain the two high vowels (/i, u/), and these will surface as vowels or glides depending on their environment, either phonological (depending on the following vowel (9a,b)) or morphological (gliding of stem-final /u/ in verbs and one or two marked morphemes). This analysis provides a straightforward account of the alternation between i and j in kui-ru ‘regret’ and kuj-asi-i ‘regretful’. It also allows alternations such as ku ~ kjuu ‘nine’ (15) to be captured as a simple deletion process, and thus leads to a more elegant account of Sino-Japanese morpheme structure.

I have also presented evidence from the structure of Sino-Japanese
morphs which bears on the position of glides in the syllable structure. This evidence suggests that when the glide is syllable-initial, it is the onset of the syllable (21a), but when preceded within the same syllable by a consonant, it is syllabified within the rime (21b).

\[
\begin{array}{ll}
(21) & (a) \quad \sigma \\
& \quad O \quad R \\
& j \quad V \\
(b) \quad \sigma \\
& \quad O \quad R \\
& C \quad j \quad V
\end{array}
\]

Grignon (1985), an analysis of the structure of the Japanese rime, does not make so much as a mention of on-glides, suggesting that she interprets them as being part of the onset. Although initially syllabified as in (21b), it is possible that rime-initial j later moves to the onset, as has been proposed for English (Borowsky 1984: 6–7; Davis & Hammond 1995: 167–8). Because the CjV structure, although now not restricted to Sino-Japanese morphemes, was introduced into Japanese due to the influence of heavy borrowing from Chinese, it is likely that CjV in the non-Sino-Japanese vocabulary has the same syllable structure.

This paper has examined several aspects of Sino-Japanese phonology, and proposed a number of morpheme-structure conditions. Japanese native speakers know that a nonce form like soa cannot be a possible Native Japanese word, although it may be a Foreign Loanword, and, if a Sino-Japanese word, must be bimorphemic. They are aware that there is no Sino-Japanese morpheme kjotu, sjatu, kui, tun and not just that there may be such forms that they do not know. In the same way that an English native speaker knows that bnick is not an English word because of his knowledge of syllable structure, the Japanese native speaker knows about the status of soa, kjotu, etc. because of his knowledge of the language’s morpheme-structure conditions.

In this paper I have also proposed various ablaut rules (fn.13) to relate morphologically related forms. Some alternations require the
application of more than one ablaut rule; for example, lowering ablaut and backing ablaut both apply to produce the alternation \textit{kin} \sim \textit{kon} 'gold'. This particular combination is also motivated in the Native Japanese vocabulary by such examples as the following:

\textit{hi} 'fire'—\textit{hokage} 'flicker of light', \textit{hokuso} 'dipped candle-wax',
\textit{hokuti} 'tinder'

\textit{ki} 'tree'—\textit{kokage} 'shade of tree', \textit{kodati} 'grove', \textit{kobiki} 'sawyer'

Although, historically, the vowel alternations in the Sino-Japanese vocabulary and those in the Native Japanese vocabulary have very different origins, these origins are beyond what may be attributed to the synchronic grammar of modern-day Japanese speakers, and the fact that they may all be captured by a small number of rules means that it would be surprising if the native language learner were not to use them to relate such alternating forms. Some may object to this use of rules to relate irregularly related morphs and unproductive alternations, but there is evidence that the native speaker does do exactly this. The brusque imperative form used with vowel-ending verb stems is -ro (\textit{ake-ro} 'open!', \textit{mi-ro} 'watch!') whereas with consonant-ending verb stems the surface form of the ending is -e (\textit{kak-e} 'write!', \textit{hasir-e} 'run!'). The alternation between -ro \sim -e is not attested in the language outside of this one morpheme, so must be considered irregular. However, there is evidence that Japanese speakers attempt to make this alternation as regular as they can, presumably based on the principle that two morphs which share the same meaning are to be interpreted as related.\(^{21}\) The two morphs -ro and -e can be brought closer to each other with no extra rules if the ending used with consonant-ending verbs is assumed to be -re. This gives the alternation -ro \sim -re, where the two morphs now share some segmental material. That native speakers perform this amount of abstraction upon irregularly related forms is evidenced by the fact that there are dialects (in Hokkaido, Akita, western

\(^{21}\) This principle is related to and competes with the principle, also used in language acquisition, that differing forms will be assumed to have different meanings until evidence shows otherwise.
Yamagata, and Niigata prefectures where the -re ending has generalised to vowel-ending verbs. This is not expected to happen if the brusque imperative ending is -ro ~ -e, because there would be no -re available.\(^\text{23}\) The two allomorphs -ro and -re can now be related by a backing ablaut process (fn.13), allowing a single underlying morpheme structure of /-re/. The morpheme remains irregular in that it is marked to undergo the minor rule of backing ablaut when attached to a vowel-ending verb stem.

I have illustrated three ways of handling exceptions – namely through the use of minor rules (such as the ablaut rules illustrated above), marking of forms as exceptions to rules, and prespecification of structure. It is an unassailable fact about language that there are exceptions, and there are certain regularities in the case of some sets of exceptions (e.g. all instances of tautomorphemic i + back-vowel sequences in the Native Japanese vocabulary have o as the back vowel (6a); both forms gen and gon 'word' (fn.13) share the same consonants and the vowels share the same phonological height). A major part of the language learning process involves discerning the regularities behind the input (this is especially evident in languages with a relatively large amount of morphophonological complexity). If the language learner is able to discern the regularities behind the regular alternations in his language, there is the possibility that he attempts to discern regularities behind the irregular alternations too. Not only is this possible; it is arguably the case, as shown by the examples in the previous paragraph.

\(^\text{22}\) This distribution was ascertained by taking dialects which had imperative -re in map 85, and checking that they were vowel-ending verb stems according to the forms in maps 72 (negative) and 118 (causative) in National Language Research Institute (1991, 1993).

\(^\text{23}\) Exactly the same kind of argument can be made using the potential form: -rare- for vowel-ending verb stems (e.g. ake-rare- 'can open', mi-rare- 'can observe') and surface -e- for consonant-ending verb stems (e.g. kak-e- 'can write', hasir-e- 'can run'). Many dialects, including Tokyo Japanese, are introducing the innovative form of -re- with vowel-ending verb stems. This is evidence that in the pre-innovation grammar the potential was -rare- ~ -re-, with r added to make the allomorphs more similar (more closely 'related') than surface -rare- ~ -e- indicates.
References


Broadcasting Culture Research Institute (ed.) (1992) NHK ことばのハンドブック 東京：日本放送出版協会


Kawakami, Shin (1977) 『日本語音声概説』東京：桜楓社.


Studies.


The Hague: Mouton.

Baltimore, MD.: Linguistic Society of America.


625.

京 : 大蔵省印刷局

Nishikawa, Makoto (1987) Japanese lexical phonology and morphology. Unpub-
lished doctoral dissertation, University of Southern California.

Ozaki, Hotuki (1972)「解説」 野坂昭如 (著) 『アメリカひじき・火垂るの墓』
234–240. 東京 : 新潮社

Pike, Kenneth L. (1967) Language in relation to a unified theory of the structure of

Poser, William (1985) Japanese evidence bearing on the compensatory lengthen-
ing controversy. In: Leo Wetzels & Engin Sezer (eds.) Studies in compensatory
lengthening, Dordrecht: Foris.

Phonology 7:121–158.

Shen, Tong (1990) The segments and skeleton in Chinese. University of Massachu-

Sibata, Takesi (監修) (1985) 『東京語アクセント資料』文部省科学研究費特定研究
「言語の標準化」資料集

Tateishi, Koichi (1990) Phonology of Sino-Japanese morphemes. University of


日本語の音韻論における高母音と半母音

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本論考では，日本語の高母音（i, u）と半母音（j, w）がほぼ相補分布をなしていることから，半母音と高母音が同一音素の異音であることを論じる。sio（塩）とsjo（書）のような対立はsioの有標性（和語形態素内のioは数例しか数えない）のために生じるもので，sioを構造的に有標にすると，この例はiとjの最小対でなくなる。

漢語形態素のCjueが基底では/Ciu/になっていると考えられる。しかし$sj$, $zj$はそれぞれ/su/, /zu/に由来するから，ここも/i/と/j/の対立を想定する必要はない。本論考では，漢語の$sj$, $zj$を/su/, /zu/から導き出すi-挿入の規則のほかに，漢語形態素の音韻構造を反映するいくつかの形態構造制約，また異形態を関係づけるいくつかの小規則を提案する。これらの小規則は和語名詞，又，活用語尾にも適用するとと思われる。

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